MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2018/2019 SESSION

PTG 0116 – TRIGONOMETRY AND COORDINATE GEOMETRY

(All sections / Groups)

15 OCTOBER 2018
2.30 p.m. – 4.30 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This question paper consists of 4 pages with 4 questions and an appendix.
2. Answer all questions.
3. Unless stated otherwise, if an answer is given as a decimal, it should be rounded to **four** significant figures.
4. Write your answers in the Answer Booklet provided.
5. Show all relevant steps to obtain maximum marks.

Question 1

(a) (i) Without using the conversion function in a calculator, convert 13.1496° to D°M'S'' form. Round your answer to the nearest second. [3 marks]

(ii) Without using the conversion function in a calculator, convert 98°9'23'' to a decimal in degrees. Round your answer to three decimal places. [3 marks]

(b) Show that $\cos 15^\circ = \dfrac{\sqrt{\sqrt{3}+2}}{2}$. [4 marks]

(c) Given $\tan 564^\circ = 0.4452$,

(i) in which quadrant 564° lies? [1 mark]

(ii) find the reference angle of 564° without using a calculator, [1 mark]

(iii) find tan of the reference angle of 564° without using a calculator, [1 mark]

(iv) find tan 204° without using a calculator, [1 mark]

(v) find tan 696° without using a calculator, [1 mark]

(vi) find sec 564° using the given information: $\tan 564^\circ = 0.4452$. [3 marks]

(d) The graph in Figure 1 is described by $y = A\cos(Bx - C)$. A and B are positive real numbers. x and C are in radians with $-\pi < C \leq \pi$.

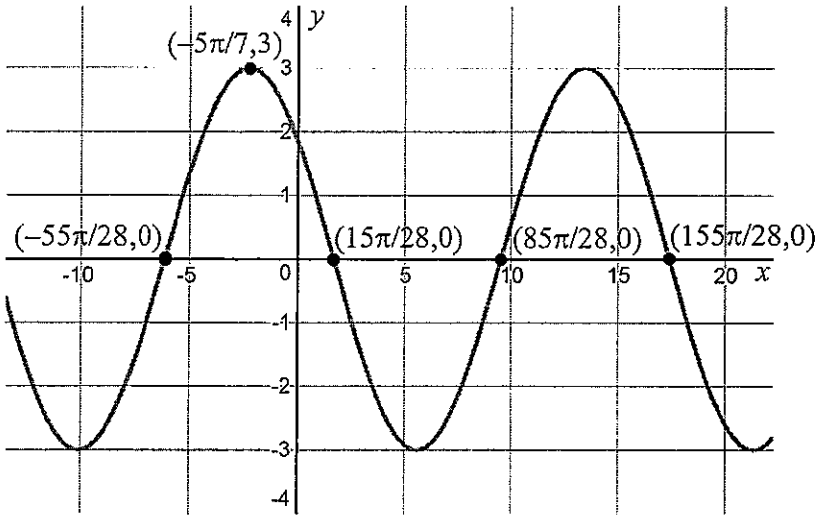

Figure 1

(i) Find the values of A, B, and C. [6 marks]

(ii) Hence, write the function that describes the graph. [1 mark]

Continued...

Question 2

(a) Let $a = 2 - i$ and $b = 1 + 2i$. Find $\frac{b\bar{a}}{a}$ in the standard form. [4 marks]

(b) Convert $3 - 4i$ to the polar form, where the argument is on $[0, 2\pi)$. [4 marks]

(c) If the argument of $x + iy$ is φ where x and y are positive, and $0 < \varphi < 2\pi$, find, in terms of φ, the arguments of

(i) $-x - iy$

(ii) $-x + iy$

(iii) $x - iy$

(iv) $2x + i2y$ [4 marks]

(Hint: Sketch the point $x + iy$ on the complex plane. Which quadrant is it in?)

(d) Given that the vectors $a\mathbf{i} + 2a\mathbf{j} + \mathbf{k}$ and $\mathbf{i} + a\mathbf{j}$ are orthogonal, find a. [4 marks]

(e) Calculate the cross product of the vectors $\mathbf{j} + 2\mathbf{k}$ and $3\mathbf{i} + 4\mathbf{j} + 5\mathbf{k}$. [4 marks]

(f) Determine if $\vec{AB}$ is parallel to $\vec{CD}$ for points $A(1, 1, 1)$, $B(2, 3, 4)$, $C(0, 0, 1)$, and $D(1, 2, 5)$. [5 marks]

Question 3

(a) Find the equation of a line containing the centres of two circles: $x^2 + y^2 - x + 4y + \frac{1}{4} = 0$ and $x^2 + y^2 + 6x - \frac{2}{3}y + \frac{46}{9} = 0$. Express the equation in slope-intercept form. [8 marks]

(b) A hyperbola is described by $-4x^2 + 9y^2 + 24x - 18y - 63 = 0$.

(i) Transform the equation into the standard form. [4 marks]

(ii) Sketch the hyperbola. Label the foci, vertices, and centre, and give their coordinates. [7 marks]

(iii) Find the asymptotes in the slope-intercept form. [5 marks]

(iv) Give the equation for the transverse axis. [1 mark]

Continued...

Question 4

(a) Solve the following system of linear equations using Cramer's rule.

$$x+4y+3z=17$$
$$z=3y$$
$$x+y+z=8$$

[15 marks]

(b) Find the product **AB** of the following matrices:

$$\mathbf{A}=\begin{bmatrix}3 & 5 & 9\\ 2 & 1 & 3\\ -1 & 2 & 0\\ 7 & 0 & 6\end{bmatrix},\ \mathbf{B}=\begin{bmatrix}2 & 3\\ 7 & -1\\ 0 & -4\end{bmatrix}$$

[7 marks]

(c) Determine the value of the unknowns in the following matrix equation:

$$\begin{bmatrix}a & 2 & 3\\ 4 & b & 6\\ 7 & 8 & c\end{bmatrix}^{\mathrm{T}}=\begin{bmatrix}1 & 4 & 7\\ 2 & 5 & 8\\ 3 & 6 & 0\end{bmatrix}$$

[3 marks]

Continued...

APPENDIX

$$\sin^2\theta+\cos^2\theta=1$$
$$\tan^2\theta+1=\sec^2\theta$$
$$1+\cot^2\theta=\csc^2\theta$$

$$\cos(A+B)=\cos A\cos B-\sin A\sin B$$
$$\cos(A-B)=\cos A\cos B+\sin A\sin B$$
$$\sin(A+B)=\sin A\cos B+\cos A\sin B$$
$$\sin(A-B)=\sin A\cos B-\cos A\sin B$$
$$\tan(A+B)=\frac{\tan A+\tan B}{1-\tan A\tan B}$$
$$\tan(A-B)=\frac{\tan A-\tan B}{1+\tan A\tan B}$$

$$\sin 2A=2\sin A\cos A$$
$$\begin{aligned}\cos 2A &=\cos^2 A-\sin^2 A\\ &=2\cos^2 A-1\\ &=1-2\sin^2 A\end{aligned}$$
$$\tan 2A=\frac{2\tan A}{1-\tan^2 A}$$

$$\sin^2 A=\frac{1-\cos 2A}{2}$$
$$\cos^2 A=\frac{1+\cos 2A}{2}$$
$$\tan^2 A=\frac{1-\cos 2A}{1+\cos 2A}$$
$$\begin{aligned}\tan A &=\frac{\sin 2A}{1+\cos 2A}\\ &=\frac{1-\cos 2A}{\sin 2A}\end{aligned}$$

$$\sin A\cos B=\frac{1}{2}\left[\sin(A-B)+\sin(A+B)\right]$$
$$\cos A\cos B=\frac{1}{2}\left[\cos(A-B)+\cos(A+B)\right]$$
$$\sin A\sin B=\frac{1}{2}\left[\cos(A-B)-\cos(A+B)\right]$$

$$\sin A+\sin B=2\sin\frac{A+B}{2}\cos\frac{A-B}{2}$$
$$\sin A-\sin B=2\cos\frac{A+B}{2}\sin\frac{A-B}{2}$$
$$\cos A+\cos B=2\cos\frac{A+B}{2}\cos\frac{A-B}{2}$$
$$\cos A-\cos B=-2\sin\frac{A+B}{2}\sin\frac{A-B}{2}$$

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